Section 78-24-27-93-1

FUEL STORAGE TANK AND COMPONENTS

02\93

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Includes Changes through Notice 5 (January 1997)

Latest Changes indicated by tokens

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L	(1995) Line Pipe
API Spec 6D	(1994; Supple June 1994) Pipeline Valves (Gate, Plug, Ball, and Check Valves)
API Spec 6FA	(1994) Fire Test for Valves
API Std 609	(1993) Lug- and Wafer-Type Butterfly Valves
API Std 650	(1993; Addenda 1; Addenda 2) Welded Steel Tanks for Oil Storage
API Std 2000	(1992) Venting Atmospheric and Low Pressure Storage Tanks: Nonrefrigerated and Refrigerated
API Std 2550	(1965; R 1992) Measurement and Calibration of Upright Cylindrical Tanks

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1996) Carbon Structural Steel
ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 131	(1989) Structural Steel for Ships
ASTM A 176	(1994) Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 182	(1996) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 193	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature

	Service
ASTM A 216	(1993) Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A 234	(1996b) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 240	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 269	(1994a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 283	(1993a) Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A 285	(1990) Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength
ASTM A 307	(1994) Carbon Steel Bolts and Studs, 60000 psi Tensile Strength
ASTM A 312	(1994b) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 325	(1994) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 351	(1996) Castings, Austenitic, Austenitic-Ferritic (Duplex) for Pressure Containing Parts
ASTM A 358	(1994a) Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service
ASTM A 403	(1995a) Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 449	(1993) Quenched and Tempered Steel Bolts and Studs
ASTM A 492	(1995) Stainless and Heat-Resisting Steel Rope Wire
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and

	Tubes
ASTM B 241	(1995a) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 247	(1995a) Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
ASTM B 345	(1995) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube for Gas and Oil Transmission and Distribution Piping Systems
ASTM C 33	(1993) Concrete Aggregates
ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 229	(1991) Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM D 396	(1992) Fuel Oils
ASTM D 1785	(1994) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2467	(1994) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2855	(1993) Making Solvent-Cemented Joints With Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3083	(1989) Flexible Poly(Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining
ASTM D 3453	(1991) Flexible Cellular Materials - Urethane for Furniture and Automotive Cushions, Bedding, and Similar Applications
ASTM E 94	(1993) Radiographic Testing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME BPV IX	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME B16.5	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B16.11	(1991) Forged Steel Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B31.1	(1995) Power Piping
ASME B31.3	(1996) Chemical Plant and Petroleum Refinery Piping

AMERICAN WELDING SOCIETY (AWS) ..REFEND

AWS A5.1	(1991) Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.4	(1992) Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS A5.10	(1992) Aluminum and Aluminum Alloy Bare Welding Rods and Electrodes

FEDERAL SPECIFICATIONS (FS)

FS SS-S-1614	(Rev A; Am 1; Notice 1) Sealants, Joint, Jet Fuel Resistant, Hot-Applied, for Portland Cement and Tar Concrete Pavements
FS VV-F-800	(Rev D; Am 2) Fuel Oil, Diesel

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports-Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hanger and Supports-Selection and Application

MILITARY SPECIFICATIONS (MS)

MS MIL-C-4556	(Rev E) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MS MIL-G-3056	(Rev F; Int Am 3) Gasoline, Automotive, Combat
MS MIL-P-24396	(May 1989) Packing Material, Braided PTFE (Polytetrafluoroethylene)
MS MIL-R-83248	(Rev B; Am 1) Rubber Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant
MS MIL-S-13789	(Rev D) Strainers, Sediment, Pipeline, Basket Type
MS MIL-T-5624	(Rev P) Turbine Fuel, Aviation, Grades JP-4 and JP-5

MS MIL-T-38219 (Rev B; Am1) Turbine Fuel, Low Volatility, JP-7

MS MIL-T-83133 (Rev D) Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35

MILITARY STANDARDS (MIL-STD) ..REFEND

MIL-STD 271 (Rev F; Notice 1) Requirements for Nondestructive Testing Methods

MIL-STD 621 (Rev A; Notice 1 & 2) Subgrade, Subbase, and Test Method for Pavement Base Course Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) ..REFEND

NEMA MG 1 (1993; Rev 1; Rev 2) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 11 (1994) Low Expansion Foam

NFPA 30 (1993) Flammable and Combustible Liquids

NFPA 70 (1996) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3275 (1994) Acrylonitrile Butadiene (NBR) Rubber Sheet, Non-Asbestos Fiber Fuel and Oil Resistant

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 6 (1994) Commercial Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL 83 (1996) Thermoplastic-Insulated Wires and Cables

UL 674 (1994; Rev thru July 1996) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations

UL 698 (1995; Rev thru July 1996) Industrial Control Equipment for Use in Hazardous (Classified) Locations

UL 886 (1994; Rev thru July 1995) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

1.2 SYSTEM DESCRIPTION

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NOTE: See Additional Note A.

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This specification provides the requirements for the construction and installation of a field-fabricated, aboveground, vertical, steel storage tank with indicated accessories.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-01 Data

Fuel Storage System; GA.

Manufacturer's standard catalog data, prior to the purchase or installation of the particular component, shall be highlighted to show brand name, model number, size, options, performance charts and curves, etc. in sufficient detail to demonstrate compliance with contract requirements on all parts and equipment including storage tanks, storage tank components, and piping components.

Calculations; FIO.

Calculations that indicate each tank's maximum and minimum operating pressures in accordance with API Std 650 Appendix F. The calculations shall also include the buoyancy of the floating pan and the structural stability of the floating pan when resting on the support legs. These calculations shall be prepared and sealed by a registered professional structural engineer.

Spare Parts Data; FIO.

Spare parts data for each different item of equipment specified, after approval of detail drawings and not later than [_____] months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for one year of operation, and a list of the parts recommended by the manufacturer to be replaced after [1] [and] [3] year(s) of service. The data shall include a completed checklist for all equipment, upon completion of the installation. Each element in the checklist shall be dated and signed.

Gauge Table; FIO.

The original and two reproductions of the table for each tank along with the accuracy certifications.

SD-04 Drawings

Fuel Storage System; GA.

Detail drawings shall be full size folded blue lines, with the title block visible. Alternative materials, dimensions, methods or departures from the Contract Drawings shall be clearly stated and be labeled as exceptions. The drawings shall include the following:

a. Tank erection details showing dimensions, sizes, thickness, gauges, materials, finishes, and erection procedures.

b. Tank component details to include as a minimum:

(1) Sand Cushion

(2) Floating pan (including details of support legs, manways, foam dams, joint attachments, anti-rotation cable, and grounding cables)

(3) Internal pipe and fittings

(4) Locations of floating pan pressure/vacuum vents, rim seals, and foam dam

(5) Details of AFFF fire protection system components

(6) Location of alarm and control switches

(7) Location of gauges

(8) Product recovery system and accessories

c. Details of the base of any component that sets on grade; complete with attachments, anchor bolt templates, and recommended clearances for maintenance and operation.

d. Details of the electric wiring indicating applicable single line and wiring diagrams with written description of sequence of operation and the instrumentation.

e. Details showing the location, type, and description of vibration isolation devices for all applications.

f. Complete piping and wiring schematic diagrams.

SD-06 Instructions

Installation; FIO.

The manufacturer's installation instructions and procedures for all equipment and components.

Framed Instructions; GA.

Framed instructions for posting, at least 2 weeks prior to construction completion.

SD-07 Schedules

Welding; GA.

A letter, at least 5 working days in advance of any welding tests, advising the Contracting Officer of the tests.

Tests; GA.

A letter, at least 10 working days in advance of each test, advising the

Contracting Officer of the date proposed date for each individual test.

Inspections; GA.

A letter, at least 10 working days in advance of each inspection, advising the Contracting Officer of the date proposed date for each individual inspection.

Demonstrations; GA.

A letter, at least 14 working days prior to the proposed training date, scheduling a proposed date for conducting the on-site training.

SD-08 Statements

Welding; GA.

A letter listing the qualifying procedures for each welder. The letter shall include supporting data such as test procedures used, what was tested to, etc. and a list of the names of qualified welders and their identification symbols.

Verification of Dimensions; FIO.

A letter stating the date the site was visited and a listing of discrepancies found.

Floating Pan; FIO.

A letter providing locations and points of contact where the floating pan design has been used in previous construction sites.

Radiographic Inspections; GA.

A letter identifying each inspector and their corresponding qualifications.

SD-09 Reports

Steel Mill Reports; FIO.

Mill reports covering chemical and physical properties of steel used in the storage tank construction.

Fire Test; GA.

[Six] [_____] copies of the information described below in bound 8-1/2 by 11-inch booklets. Drawings shall be folded blue lines with the title block visible.

(1) A list of equipment used along with calibration certifications.

(2) A copy of measurements taken.

(3) The date of testing.

(4) The parameters to be verified.

(5) The condition specified for the parameter.

(6) The test results, signed and dated by the manufacturer's representative.

Tests; GA.

[Six] [_____] copies of each test containing the information described below in bound 8-1/2 by 11-inch booklets. Individual reports shall be submitted for the sand cushion tests, the storage tank tests, the floating pan tests, and the piping tests. Drawings shall be folded blue lines with the title block visible.

(1) A list of equipment used along with calibration certifications.

(2) A copy of measurements taken.

(3) The date of inspection.

(4) The parameters to be verified.

(5) The condition specified for the parameter.

(6) The inspection results, signed, dated, and certified by the field engineer. The certification shall state that all required procedures were accomplished, that the procedures were conducted in compliance with the plans and specifications.

(7) A description of adjustments performed.

Inspections; GA.

[Six] [_____] copies of each inspection containing the information described below in bound 8-1/2 by 11-inch booklets. Individual reports shall be submitted for the storage tank inspections, the floating pan inspections, and the piping inspections. Drawings shall be folded blue lines with the title block visible.

(1) A list of equipment used along with calibration certifications.

(2) A copy of measurements taken.

(3) The date of the inspection.

(4) The parameters and conditions to be verified.

(5) The inspection results, signed, dated, and certified by the installation Contractor. The certification shall state that all required procedures were accomplished and conducted in compliance with the plans and specifications.

(6) A description of adjustments performed.

(7) The film and inspection reports of radiographic inspections.

SD-13 Certificates

Experience; GA.

Evidence of the installation Contractor's experience, training, and licensing.

SD-14 Samples

Special Tools; GA.

Two sets of special tools required for maintenance. Special tools are those that only the manufacturer can provide for special purposes such as reaching otherwise inaccessible parts. The tools shall be supplied complete with a suitable tool box.

SD-19, Operation and Maintenance Manuals

Operation Manuals; GA.

[Six] [_____] complete copies, at least 2 weeks prior to the demonstrations, of operation manuals in bound 8-1/2 by 11-inch booklets listing step-by-step procedures required for system startup, operation, and shutdown. The manuals shall include the manufacturer's name, model number, service manual, a brief description of each piece of equipment, and the basic operating features of each piece of equipment.

Maintenance Manuals; GA.

[Six] [_____] complete copies, at least 2 weeks prior to the demonstrations, of maintenance manuals in bound 8-1/2 by 11-inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping, equipment layouts, and simplified wiring and control diagrams of the system as installed.

1.4 QUALIFICATIONS

1.4.1 Experience

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NOTE: Include any local regulatory requirements that must be met by the Contractor.
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The installation Contractor shall have successfully completed manufacturer's training courses on the installation of storage tanks, piping, and tank management systems; have at least 5 years experience in the erection of aboveground vertical steel tanks with floating pans and fixed roofs; and meet the licensing requirements in the state.

1.4.2 Welding

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NOTE: Include necessary safety precautions to be taken if welding is to be performed at an existing tank farm/yard area.
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Welding shall be in accordance with qualifying procedures using performance qualified welders and welding operators. Welding tests shall be performed at the work site. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer [may be

accepted as permitted by ASME B31.1] [are not be acceptable]. Each welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section [_____].

1.4.3 Radiographic Inspections

Inspectors to perform radiographic inspections on tank welds shall have qualifications in accordance with API Std 650. Inspectors to perform radiographic inspections on pipe welds shall have qualifications in accordance with MIL-STD 271 or ASTM E 94.

1.5 REGULATORY REQUIREMENTS

The design, fabrication, and installation of the entire fueling system shall be in accordance with this specification as well as meet all federal, state, and local code requirements.

1.6 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperatures, pressures, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

1.7 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather and contamination. Proper protection and care of all material before, during, and after installation is the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8.2 Testing and Flushing

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Note: See Additional Note B.
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Products (water, fuel, etc.) required for the testing and flushing of materials, equipment, piping, etc. (excluding the storage tanks) as specified in this section shall be provided and disposed of by the [Contractor] [Contracting Officer]. The [Contractor] [Contracting Officer] will provide the necessary water, fuel, and labor required for tank testing.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

System components shall be environmentally suitable for the locations shown and shall be the manufacturer's standard as offered in catalogs for commercial or industrial use. Any non-standard product or component and the reason for its use shall be specifically identified by the Contractor in any required submittal.

2.2 NAMEPLATES

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NOTE: See Additional Note C.
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Each major component (tanks, pumps, control valves, filter-separators, etc.) shall have a nameplate to list the manufacturer's name, address, component type or style, model or serial number, and catalog number on a plate secured to the equipment. Plates shall be durable and legible throughout equipment life and made of [anodized aluminum] [stainless steel] [_____]. Plates shall be fixed in prominent locations with nonferrous screws or bolts. One manway cover on each tank shall have a nameplate that describes special and important procedures for operating and servicing the system. The nameplate shall include warnings of hazardous procedures.

2.3 ELECTRICAL WORK

Electrical equipment, motors, and wiring shall be in accordance with Section [_____]. Each motor shall conform to NEMA MG 1 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage. Electrical characteristics and enclosure type shall be as shown, and unless otherwise indicated, motors of 1 horsepower and above with open, dripproof, or totally enclosed fan cooled enclosures, shall be high efficiency type. Motors shall be continuous duty with the enclosure specified. Switches and devices necessary for controlling the electrical equipment shall be provided. The pumps shall be completely wired and ready for connection to the power circuit. Wiring, equipment, and fittings shall be explosion-proof in conformance with the applicable requirements of UL 674, UL 698, and UL 886 for Class I, Division l, Group C and D hazardous locations. Electrical installations shall conform to the requirements of the NFPA 70. Underground electrical wiring shall be enclosed in PVC coated conduit which shall be isolated from steel tanks with dielectric fittings.

2.4 MATERIALS

2.4.1 Fuels

Galvanized materials (zinc coated) shall not be allowed direct contact with any type fuel. Materials which come in contact with aviation fuel shall be noncorrosive (i.e. stainless steel, aluminum, etc.). Fuels as required by this specification shall be in accordance with the following:

2.4.1.1 Motor Gasoline (Mogas)

Mogas shall be in accordance with MS MIL-G-3056.

2.4.1.2 Diesel

Diesel shall be in accordance with FS VV-F-800.

2.4.1.3 Fuel Oils

Number 2, 4, and 6 fuel oils shall be in accordance with ASTM D 396.

2.4.1.4 JP-4 and JP-5

Fuels shall be in accordance with MS MIL-T-5624.

2.4.1.5 JP-7

Fuel shall be in accordance with MS MIL-T-38219.

2.4.1.6 JP-8

Fuel shall be in accordance with MS MIL-T-83133.

2.4.2 Gaskets

Gaskets shall be factory cut from one piece of material.

2.4.2.1 Nitrile Butadiene (Buna-N)

Buna-N material shall be in accordance with SAE AMS 3275.

2.4.2.2 Acrylonitrile Butadiene Rubber (NBR)

NBR material shall be made of material conforming to SAE AMS 3275.

2.4.3 Structural Steel Shapes

Fabricated structural steel shapes shall be in accordance with ASTM A 36.

2.4.4 Bolts

Bolts used for structural steel connections shall be in accordance with ASTM A 307 and ASTM A 325.

2.4.5 Anchor Bolts

Anchor bolts shall be in accordance with ASTM A 307 and ASTM A 449.

2.4.6 Bird Screens

Vents, ports and similar openings shall be screened with 1/2" expanded metal bird screen.

2.4.7 PVC Mounting Strip

The PVC mounting strip used to mount the FML shall be in accordance with ASTM D 3083.

2.5 STORAGE TANKS

Materials used in the construction of a storage tank shall be aluminum, carbon steel, stainless steel, or a combination of each.

2.5.1 Aluminum

Bars, rods, shapes and tubes shall be extruded and conform to the requirements of ASTM B 221. Plates and sheets shall conform to the requirements of ASTM B 209.

2.5.2 Carbon Steel

Plates and structural members shall conform to the requirements of API Std 650, Section 2 - "Materials" with a minimum corrosion allowance of 1/16-inch. Storage tank appurtenances not covered by API Std 650 shall be in accordance with ASTM A 36, ASTM A 131, ASTM A 283, or ASTM A 285 as applicable.

2.5.3 Stainless Steel

Stainless steel plates shall be Type 304 in accordance with ASTM A 240. Stainless steel columns shall be in accordance with ASTM A 358, Grade 304L, with a minimum thickness of 1/2-inches. Stainless steel plates for miscellaneous use shall be in accordance with ASTM A 176.

2.6 STORAGE TANK COMPONENTS

2.6.1 Sand Cushion

Cushion shall be located on top of the flexible membrane liner (FML) and beneath the tank bottom plates. Cushion shall be a minimum of 8-inches thick and be fine sand aggregate in accordance with ASTM C 33. Cushion shall contain no more than 25 parts per million (ppm) chlorides, no more than 30 ppm sulfates, and have a pH greater than 7. Magnesium sulfate shall be used in the ASTM C 88 soundness test.

2.6.2 Floating Pan

The floating pan shall be naturally buoyant by means of non-perforated, individually sealed, closed cell type honeycomb cells (maximum horizontal plane dimensions of 1 inch by 1 inch). A rim shall be provided around the floating pan periphery and penetrations and extend a minimum of 6-inches above the free liquid surface. The rim shall contain turbulence and prevent fuel from splashing up onto the top surface of the floating pan.

2.6.2.1 Pan Integrity

The floating pan shall support the following loading conditions without causing damage to the pan, sinking the pan, or allowing product to spill onto the top surface of the pan in the event the pan is punctured.

(1) A uniform load of three times the weight of the pan.

(2) For tanks larger than 30 feet in diameter, a point load of 500 pounds on a one square foot area anywhere on the floating pan while it is floating or resting on the legs.

(3) For tanks 30 feet in diameter and less, a point load of 250 pounds on a one square foot area anywhere on the floating pan while it is floating or resting on the legs.

2.6.2.2 Joint Connections

Aluminum sandwich panels shall be joined together by means of a gasketed joint that transmits loads without structural failure or leakage.

2.6.2.3 Aluminum Extrusions

Extrusions shall be made from alloy 6063-T6 in accordance with ASTM B 209.

2.6.2.4 Aluminum Sandwich Panels

Panels shall be made from alloy 3003 H14, 3003 H16, 3105 H14, 5010 H24, or 5052 H32 in accordance ASTM B 209. The skin of the panels shall have a minimum thickness of 0.014-inches. The core of the panels shall be 1-inch aluminum honeycomb, non-perforated.

2.6.2.5 Support Legs

Floating pan shall be provided with two position self draining legs that are designed to support a uniform load of 12.5 pounds per square foot. The legs shall be tubular structural members of aluminum or stainless steel at least 2-inches in diameter and ride with the pan when the fuel level is above the high position. The low position shall be 36-inches and high position 75-inches. The exact location and number of the support legs shall be as recommended by the floating pan manufacturer. The legs shall be capable of allowing a person, standing on top of the floating pan while the tank is in service, to perform the following functions:

(1) Change from the high to the low position.

(2) Change from the low to the high position.

(3) Completely remove the legs.

(4) Adjust the legs vertically a distance equal of plus or minus 3-inches.

2.6.2.6 Periphery Seals

Periphery seals shall be made of flexible polyurethane foam in accordance with ASTM D 3453 and be covered with a polyurethane coated polyester fabric wrap at least 0.025-inch thick. The periphery seal shall fit the space between the tank shell and the outer edge of the floating pan with two flexible seals, a primary and a secondary. The seals, primary and secondary as a unit, shall accommodate a deviation between the path of the floating pan relative to the tank shell of an additional 4-inches of compression and an additional extension of 2-inches from its normal compressed position at any fluid level. The primary seal shall be above the liquid level and be free draining without trapping any liquid. The secondary seal shall be above the primary seal. Seals shall be capable of being replaced during tank operations, be durable in the tank's environment, be abrasion resistant, and not discolor or contaminate the liquid stored in the tank.

2.6.2.7 Penetration Seals

Penetration seals shall be made of Buna-N. Vertical appurtenances such as columns, ladders, cable, etc. that penetrate the floating pan shall have seals that permit a local deviation of plus or minus 5-inches and have a rim that extends a minimum of 6-inches above the free liquid to contain product turbulence and prevent the tank product from splashing up onto the top surface of the floating pan.

2.6.2.8 Manway

A manway shall be provided for each floating pan to provide access to the tank interior when the floating pan is on its supports and the tank is empty. Manway shall have an clear inside diameter of at least 30-inches. The cover shall be bolted fuel tight to the floating pan with a Buna-N gasket. Manway shall have a rim that extends a minimum of 3-inches above the free liquid to contain product turbulence and prevent the tank product from splashing up onto the top surface of the floating pan.

2.6.2.9 Foam Dam

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NOTE: Delete this paragraph only when tanks smaller than 55,000 barrels are specified.

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A foam dam shall be constructed of aluminum and mounted directly to the top of the floating pan. The dam shall be supported by braces as indicated. The dam shall be constructed in accordance with NFPA 11 dimensions.

2.6.2.10 Grounding Cables

Two or more 1/8-inch diameter grounding cable made of 304 stainless steel aircraft cable conforming to ASTM A 492, with a maximum resistance of 8.5 ohms per 100 feet shall be provided for each tank. The exact location and number of grounding cables shall be as recommended by the floating pan manufacturer.

2.6.2.11 Anti-Rotation Cable

One 1/4-inch diameter anti-rotation cable made of 304 stainless steel conforming to ASTM A 492 shall be provided for each tank. Fittings for anti-rotation cables including cable clamps, pins, sockets, turnbuckles, U-bolts and nuts, etc. shall be 304 stainless steel. Cable shall be made taut by means of the turnbuckle. The exact location of the anti-rotation cable shall be as recommended by the floating pan manufacturer.

2.6.2.12 Fire Test

The floating pan design shall be fire tested by both of the following tests being applied to a test floating pan. The test floating pan shall be floated in gasoline. Successful conclusion of each fire test shall show that the design is adequate if no significant damage occurs to the pan, the pan continues to float, and the fire did not spread to the entire surface of the fuel.

(1) Hole Fire: The test floating pan shall have a 12-inch or larger diameter hole cut through it. After being lit, the fuel in the hole shall burn for a minimum of two hours.

(2) Rim Fire: After being lit, the fuel in the test rim section shall burn for a minimum of two hours.

2.6.3 Access Ladder

Ladder shall have a safety rail system with three safety belts and trolleys. The rail shall have a removable extension with clamps.

2.6.4 Shell Manhole

Manhole shall be gasketed fuel tight with a Buna-N or NBR gasket.

2.6.5 Fixed Roof

The roof-to-shell joint shall be the frangible type as defined in API Std 650 Appendix F, NFPA 30, and API Std 2000 to satisfy emergency venting requirements. Tank roof shall have a bolted rectangular opening suitable for installation of floating pan panels.

2.6.6 Roof Manway

Manway shall be gasketed fuel tight, with a Buna-N gasket and include a gauge hatch. The gauge hatch shall be made of aluminum conforming to ASTM B 247 or bronze conforming to ASTM B 62, have a cover that is foot-operated to open, self-closing, lockable, and gasketed fuel tight with a Buna-N gasket.

2.6.7 Roof Inspection Hatch

A minimum of 4 hatches are required per tank. The maximum space between hatches shall be 75 feet. Designs that combine inspection hatches with circulation vents on the roof are acceptable.

2.6.8 Emergency Overflow Slot

Slot shall comply with API Std 650, Appendix H.

2.6.9 Circulation Vent

Venting for tanks shall comply with API Std 650, Appendix H.

2.6.10 Stairway

Stairway shall be supported completely on the shell of the tank with ends of the stringers clear of the ground and be constructed entirely of steel. At platform access openings, any space wider than 6-inches between the tank and the platform shall be floored.

2.6.11 Handrails

A continuous handrail shall be provided around the full perimeter of the tank roof, around the platforms, and down the stairway. The handrail shall be non-continuous only at access platforms and at roof vent/inspection hatches.

2.6.12 Interior Tank Coating

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NOTE: See Additional Note D.
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Interior tank coating shall be applied to [all interior surfaces including piping and appurtenances] [the tank bottom and 1 meter up the tank shell] in accordance with Section [_____]. Overlapping areas in the roof and at the joint of the roof plate and tank shell shall require caulking in

accordance with Section [_____]. Tank shall have the interior coating applied following the completion of the water fill tightness test. The exterior of carbon steel piping inside the tank shall be coated equal to the tank interior coating. Areas between the underside of the tank roof and the top surface of the rafters shall be coated. Contractor will be allowed to insert small wooden blocks between the roof and the rafters, sandblast the area, and then apply the coating. After the coating has dried, remove the blocks to allow the blocked areas to be sandblasted, coated, and dried.

2.6.13 Foundation Ring Wall Mastic Seal

The mastic seal for sealing the foundation ring wall shall be a jet fuel-resistant sealant conforming to the requirements of FS SS-S-1614.

2.6.14 Aqueous Film Forming Foam (AFFF) System

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Note: See Additional Note E.
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A semi-fixed AFFF fire protection system shall be provided for each storage tank in accordance with NFPA 11 and NFPA 30. The system shall spread foam [evenly over the entire top of the floating pan] [between the tank shell and the foam dam by means of a split steel deflector located inside the tank shell]. Foam chambers, located on the tank exterior, shall be constructed of steel and be coated with manufacturer's standard epoxy finish. The epoxy finish shall be the color red. The piping inside the tank, piping outside the tank, and the foam chambers shall be easily drainable.

2.6.15 Water Draw-Off System

A water draw-off system shall be provided for each bulk and operating storage tank. Each system shall include tank, product return pump and all necessary pipe, valves and fittings. Components of the water draw-off system shall be installed and secured in place by anchor bolts.

2.6.15.1 Tank

The water draw-off tank and support legs shall be fabricated from ASTM A 176 Type 304 stainless steel.

2.6.15.2 Sight Glass

Sight glasses for the water draw-off tank shall be standard tubular gauges with density ball and shutoff valves on each end. Wetted parts other than sight glass shall be stainless steel. If glass breakage should occur, a stainless steel ball in the valve shall close preventing product loss. Glass shall be protected by minimum of four guard rods.

2.6.15.3 Product Return Pump

Pump shall have the capacity of not less than 5 gpm against a total head of 65 feet. Pump motor shall be in accordance with NEMA MG 1 and UL 674. Pump shall have no zinc, brass or other copper bearing alloys in contact with the fuel. The unit shall be U.L. listed and labeled, explosion-proof,

for use in Class I, Division 1, Group D hazardous environment as defined by NFPA 70, with maximum temperature rating of T2D-419 degrees F. The motor shall not be overloading at any point on the pump curve. The pump shall be the centrifugal or positive displacement type with a maximum speed of 3500 rpm and a net positive suction head requirement of 20 feet. Positive displacement type pumps shall include a full flow rate, internal or external pressure relief between the discharge and suction protecting the pump from overloading.

2.6.16 Level Alarm System

System shall be designed and installed in such a way that the system shall be continuously and automatically self-checking without manual check. Electronic level sensors shall be thermistors or optic types, and be intrinsically safe Class I, Division 1, Group D for hazardous environments, with recognized FM, CSA or UL approval, Both high electronic level sensors shall be contained in a single multi-sensor holder/junction box. The sensor holder/junction box shall be accessible from the tank top or stairway.

2.6.16.1 Electronic Level Alarms

Level alarms shall be mechanically and electrically independent and be totally isolated from the gauging system. Two electronic high level alarms shall be provided for each tank. A High Level Alarm (HLA) shall be set at approximately 95 percent of the safe tank filling height and be arranged to actuate an audible alarm signal located at or near the normal station of the person in control of the tank filling operation. A High High Level Alarm (HHLA) shall be set at approximately 98 percent of the safe filling height. HHLA shall sound an audible and visual alarm at a control panel and close the High Liquid Level Control Valve. In addition, an electronic low level alarm shall actuate a visual and audible signal at the control panel when the tank is less than 5 percent filled.

2.6.16.2 Level Alarm Control Panel

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NOTE: Indicate the location of the panel. Panel should be located in a non-hazardous location.
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Panel shall be located where indicated and contain one light and one relay output for each alarm point. An audible alarm shall actuate whenever any alarm point has been reached. Panel shall further contain a green (Power ON) status light and push button controls for alarm reset and test. Panel shall consist of a NEMA 4 style water-tight housing for outdoor mounting locations. panel shall operate with 115 VAC input power. Circuitry and cables from the panel to the electronic level sensors in the tank shall be intrinsically safe.

2.6.17 Mechanical Tape Level Gauge

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NOTE: Delete this paragraph if Servo Level gauges are specified.
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The mechanical tape gauge shall be complete with all necessary incidental

pipe, pulleys, fittings, supports, support brackets, tension spring, and guide wire assemblies. The gauge shall automatically provide the location of the floating pan within plus or minus 1/16-inch of the actual liquid level. The head shall be made of aluminum and be mounted on the exterior of the tank shell approximately 4'-6" feet above the tank bottom. The head shall contain a glass covered window complete with an inside wiper. The seals shall be made of teflon. The shafts, graduated tape, and tape drum assembly shall be made of stainless steel. The tape shall be of sufficient length to measure the liquid level from the bottom to the top of the storage tank. Gauge measurements shall be graduated in 1/16-inch increments. The tape shall be carried over pulleys housed in elbow assemblies at each change of direction. For data transmission, the mechanical tape gauge head shall be provided with a direct gear, non-contacting optical digital encoder coupled to the gauge shaft. Transmitter shall provide a 4-20 MA signal to a remote digital receiver/indicator. Transmitter shall be powered from the remote receiver.

Encoder/transmitter shall be UL listed and/or FM approved as intrinsically safe for use in a Class I, Division 1, Groups C and D, hazardous environment.

2.6.18 Servo Level Gauge

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NOTE: Delete this paragraph if Mechanical Tape gauges are specified.

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2.6.18.1 Construction

The materials of construction of the servo level gauge, excluding "O" ring gaskets, magnetics, and electronic components, shall be constructed of either ASTM A 492 type 316 stainless steel or cast aluminum. "O" ring gaskets shall be constructed of Buna-N. The servo level gauge shall be Underwriters Laboratory, Inc. (UL) or Factory Mutual (FM) labeled for Class I, Division 1, Group D hazardous areas, and shall have maximum temperature rating of "T2D" - 419 degrees F as defined by NFPA 70. The nameplate shall include the temperature rating. Unit shall be provided with a thermostatically controlled heater for prevention of condensation and freeze protection and an RTD and self compensating temperature converter. Unit shall receive 120 volts, single phase power and shall consume 60 VA, maximum.

2.6.18.2 Assembly

The automatic tank level gauge assembly shall include a servo level gauge, an ASTM A 492 type 316 stainless steel measuring wire, an unguided 5.7-inch diameter type 316 stainless steel displacer, an aluminum calibration chamber, local and remote level indications, and an aluminum stilling well.

The measuring wire shall be of sufficient length to measure the liquid level from the bottom to the top of the storage tank.

2.6.18.3 Gauge Operation

The displacer shall indicate to the servo level gauge a rise or fall in the liquid level of the tank. The servo level gauge shall be capable of sensing any movement of the displacer and provide both a local and a remote liquid level indication. The servo level gauge shall have a measuring accuracy of plus or minus 0.01 feet.

2.6.18.4 Data Transmission

When the servo level gauge senses a rise or fall in the tank liquid level, the internal processor shall be capable of providing serialized output capable of being transmitted over a two-wire bus to remote receiver/indicator units. The units of measurement shall be feet and measuring increments shall be in hundredths (0.01) of a foot. Wave integration time shall be 1 to 10 seconds, adjustable.

2.6.19 Tracer Gas Detection System

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Note: The tracer gas test is optional and is not shown on any of the standard drawings. If the test is desired, include any necessary detail drawings.

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2.6.19.1 System

A tracer gas vapor collection/distribution system shall be installed in the sand below the tank bottom prior to tank construction. This shall include 3/4-inch PVC pipe laid horizontally under the tank bottom. Pipe shall be at least 9-inches below the tank bottom in the sand to avoid damage during welding of the tank bottom. The number of probes shall be as indicated on the drawings and be determined by locating 20 foot diameter circles on the tank bottom beginning at the center of the tank. Each of these circles represents the influence of one probe. Circles shall overlap so that all areas of the tank bottom are covered. Probes shall be of sufficient length to extend from the center of each circle of influence to a termination point at the exterior of the ring wall.

2.6.19.2 Exterior Termination Points

Exterior termination points shall be 3/4-inch female pipe threads with a 3/4-inch plug located at the exterior of the concrete ring wall. The probe shall be connected to the coupling using a threaded adapter.

2.6.19.3 Interior Termination Points

Interior termination points (under tank bottom) shall be covered with a material designed to deter soil erosion while allowing air and water to move in and out of the open probe end. This material shall not be affected by hydrocarbons and shall be corrosion protected.

2.7 PIPING COMPONENTS

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Note: See Additional Note F.

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Unions and other threaded fittings shall not be used. Elbows of 45 and 90 degrees shall be the long radius type. Pipe joints shall be either welded or flanged with flanged connections being indicated. Girth welds shall be complete penetration groove welds. Weld preparation shall comply with the

requirements of ASME B31.3. The use of "rice paper" as purge blocks and backing rings for making or repairing welds shall not be permitted. Weld surfaces shall be merged smoothly with the base metal surface. Interior piping shall not be anchored to its supports or to the tank bottom.

2.7.1 Fill and Withdrawal Piping

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NOTE: Stainless steel or aluminum piping should be selected for fill and withdrawal piping for operating tanks servicing aircraft direct hydrant refueling systems.

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Fill and withdrawal pipe external to a storage tank shall be [unlined carbon steel] [lined carbon steel] [stainless steel] [aluminum]. Pipe internal to a storage tank shall be stainless steel.

2.7.2 Water Draw-Off Piping

Water draw-off pipe external to a storage tank shall be unlined carbon steel. Pipe internal to a storage tank shall be stainless steel.

2.7.3 AFFF & Vent Piping

AFFF system piping and center column vent piping shall be stainless steel.

2.7.4 Monitoring Well Piping

Monitoring well piping shall be PVC pipe that is commercially manufactured to have 0.010-inch wide slots with a minimum opening per linear inch of 0.240 square inches.

2.7.5 Steel Pipe

Carbon steel pipe shall be in accordance with ASTM A 53, Type E or S, Grade A or B, or API Spec 5L, seamless or electric-weld, Grade A or B. Pipe smaller than 2-1/2 inch shall be in Schedule 80. ASTM A 53 pipe 2-1/2 inch and larger shall be Schedule 40. API Spec 5L pipe 2-1/2 inch and larger shall be Schedule 40S. Pipe larger than 10-inches shall have a wall thickness of 0.375-inch.

2.7.5.1 Connections

Connections for pipe or fittings smaller than 2-1/2 inch shall be forged, socket weld type, 2000 W.O.G. conforming to ASTM A 182 and ASME B16.11. Connections for pipe or fittings 2-1/2 inch and larger shall be butt weld type conforming to ASTM A 234, Grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe.

2.7.5.2 Welding Electrodes

Welding electrodes shall be E70XX low hydrogen type conforming to AWS A5.1 or AWS A5.4.

2.7.6 Stainless Steel Pipe

Stainless steel pipe 6-inches or smaller shall be in accordance with ASTM A 312 Schedule 40, Type TP304L, seamless only. Stainless steel pipe 6-inches

and larger shall be in accordance with ASTM A 312 Schedule 10S, Grade 304L, seamless only or ASTM A 358 Grade 304L, Class 1 or 3, welded with wall thickness no less than 1/4-inch for pipe 12-inches and smaller, and 0.312-inch for pipe larger than 12-inches.

2.7.6.1 Connections

Connections for pipe or fittings smaller than 2-1/2 inch shall be forged, socket-weld type, Type 304 or 304L, 2000 W.O.G. conforming to ASTM A 182 and ASME B16.11. Connections for pipe or fittings 2-1/2 inch and larger shall be the butt-weld type conforming to ASTM A 403, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same wall thickness as the adjoining pipe.

2.7.6.2 Welding Process

The welding process for stainless steel piping shall be a gas tunston arc or gas metal arc process in accordance with ASME B31.3.

2.7.6.3 Welding Electrodes

Welding electrodes shall be E308L conforming to AWS A5.4.

2.7.7 Aluminum Pipe

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NOTE: Carefully consider including aluminum piping into a design due to welding difficulties and poor structural integrity.

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Aluminum piping shall be in accordance with ASTM B 241 or ASTM B 345, alloy 6061-T6. Pipe smaller than 2-inches shall be Schedule 80. Pipe 2-inches and larger shall be Schedule 40.

2.7.7.1 Connections

Socket welded connections shall be in accordance with ASME B16.11, except aluminum shall be alloy 5083-H112, alloy 6061-T6, or alloy 356-T6. Buttwelded connections shall be in accordance with ASME B16.9, except aluminum shall be in accordance with ASTM B 241, alloy 6061-T6, of the same weight as the pipe.

2.7.7.2 Welding Process

The welding process for aluminum piping shall be a gas tunston arc or gas metal arc process in accordance with ASME B31.3.

2.7.7.3 Welding Electrodes

Welding electrodes shall be ER5356 conforming to AWS A5.10.

2.7.8 PVC

PVC pipe shall conform to ASTM D 1785, Schedule 80. PVC pipe fittings shall be socket fittings conforming to ASTM D 2467. PVC joints and fittings shall be solvent-cemented to conform with ASTM D 2855 using solvent cement conforming to ASTM D 2564.

2.7.9 Lined Pipe Coating

Interior of lined piping shall be factory coated in accordance with MS MIL-C-4556.

2.7.10 Manual Valves

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NOTE: Require stainless steel or aluminum construction only if aviation fuels are to be handled.

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Portions of a valve coming in contact with fuel shall be compatible with the fuel to be handled. Valves shall have bodies, bonnets, and covers constructed of [stainless steel conforming to ASTM A 351, Type 304L or Type 316 with Type 316 stainless steel backup rings; or aluminum alloy conforming to ASTM B 247, Type 3003, 6061-T6, or 356-T6.] [cast steel conforming to ASTM A 216, Grade WCB internally plated with chromium, nickel, or electroless nickel]. Stem and trim shall be stainless steel for all valves. Valves shall be suitable for a working pressure of 275 psig at 100 degrees F with a weatherproof housing. Valve packing shall be Viton in accordance with MS MIL-R-83248 or Polytetrafluoroethylene (PTFE) in accordance with MS MIL-P-24396. Valves shall be provided with flanged end connections which are constructed of the same material as the pipe.

2.7.10.1 Gate

Valve shall be in accordance with API Spec 6D and conform to the fire test requirements of API Spec 6FA. Valve shall be of the flexible wedge disc type, conduit disc type, or double disc type. Valve shall be of the rising stem type with closed yoke, or the non-rising stem type equipped with a device to give positive visual indication of the valve's position.

2.7.10.2 Check

Valve shall be swing type conforming to API Spec 6D regular type. Check valves shall be the tilting disc, non-slam type. Discs and seating rings shall be renewable without removing from the line. The disc shall be guided and controlled to contact the entire seating surface.

2.7.10.3 Ball

Valves 2-inches and larger shall conform to API Spec 6D. Valves smaller than 2-inches shall have one piece bodies and have a minimum bore not be less than 55 percent of the internal cross sectional area of a pipe of the same nominal diameter. Each valve shall have hand operated levers, a full ported ball, and a type 316 stainless steel ball and stem. Each valve shall be fire tested and qualified in accordance with API Spec 6FA. Each valve shall be non-lubricated and operate from fully open to fully closed with 90 degree rotation of the ball.

2.7.10.4 Butterfly

Valve shall be the high performance type with eccentric disc shaft and camming action for bubble-tight bidirectional shutoff service at maximum pressure rating. Valve shall be in accordance with API Std 609. Each valve shall be fire tested and qualified in accordance with API Spec 6FA.

2.7.10.5 Plug

Valve shall have a locking device, mechanical position indicators, weatherproof operators, and be in accordance with API Spec 6D. Valve shall be non-lubricated, resilient, double seated, trunnion mounted type with a tapered lift plug capable of two-way shutoff. Valve shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Sealing slips shall be capable of being removed and replaced without removing the valve. Each plug valve shall have a manually operated bleed valve that can be opened to verify that plug valves are not leaking when in the closed position. Plug valves in tank fill and withdrawal piping shall have factory-installed fill limit switches (each switch shall have one DPDT contact, be watertight, and be UL listed for Class I, Division 1, Group D hazardous area with a T2D - 419 degree F. temperature limitation) that are actuated by the valve operators.

2.7.11 Relief Valve

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NOTE: See Additional Note G.

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Valve shall be the plug or ball check type capable of maintaining a constant upstream pressure regardless of the downstream demand. Valve shall be normally closed, line-pressure-operated, spring loaded, and fully guided between the closed and fully opened positions. Valve shall have an angle or straight pattern as indicated. Valves shall be factory-set to open at the indicated pressure and be field adjustable. Valve setpoint shall be adjustable within a minimum range of plus or minus 20 percent of the indicated setpoint. Each valve shall be provided with a [stainless steel] [cast steel] sight flow indicator that has flanged end connections. The sight flow indicator shall consist of a housing containing a rotating propeller that is visible through a glass observation port.

2.7.12 High Liquid Level Control Valve

2.7.12.1 Valve

Valve shall be hydraulically operated, single-seated, normally closed, diaphragm actuated, on/off type valve. Valve shall be field adjustable. Valve shall be provided with a position indicator, float operator and assembly, pressure-operated pilot valves and accessories, solenoid-operated pilot valve, and pressure gauge quick-disconnect fittings located in the valve inlet, outlet, and cover. Valve shall also operate with a special check valve feature and close rapidly when outlet pressure exceeds inlet pressure. Service and adjustments shall be possible without removing the valve from the line. Portions of the valve coming in contact with fuel shall be compatible with the fuel and be of noncorrosive material. Valve shall have bodies, bonnets, and covers constructed of [stainless steel conforming to ASTM A 351, Type 304L or Type 316 with Type 316 stainless steel backup rings; or aluminum alloy conforming to ASTM B 247, Type 3003, 6061-T6, or 356-T6.] [cast steel conforming to ASTM A 216, Grade WCB internally plated with chromium, nickel, or electroless nickel]. Stem and trim shall be stainless steel. Valve shall be suitable for a working pressure of 275 psig at 100 degrees F with a weatherproof housing. Valve packing shall be Viton in accordance with MS MIL-R-83248 or PTFE in accordance with MS MIL-P-24396. Valve shall be provided with flanged end connections which are constructed of the same material as the valve body.

2.7.12.2 Float Operator and Assembly

Float operator and assembly shall be Type 304L or Type 316 stainless steel conforming to ASTM A 351. Float operator shall be field adjustable. Float operator shall control the high liquid level control valve based on the indicated actuation point. The float operator and assembly shall be mounted to the storage tank's exterior where indicated. Means shall be provided to test the float operator's operation and the control system's response.

2.7.12.3 Pressure-Operated Pilot Valves and Accessories

Valves shall be the adjustable, pressure-operated type and be adjustable in the field. Valves shall be tag identified and be stainless steel conforming to ASTM A 351, Type 304L or Type 316 with stainless steel internal working parts. A 40 mesh stainless steel screen, self-cleaning strainer shall be provided in the pilot valve supply piping. Pilot system tubing shall be Type 316 stainless steel in accordance with ASTM A 269. Control, supply, and return connections shall be provided with isolation valves. Tubing connections shall be made with unions and not be welded or sealed with "O" rings.

2.7.12.4 Solenoid-Operated Pilot Valve

Valve shall be used for the electronic level alarm sensor control of the high liquid level control valve. Valve shall be tag identified and be stainless steel conforming to ASTM A 351, Type 304L or Type 316 with stainless steel internal working parts. Valve shall have a manual type operator or needle valve for emergency manual bypass operation. Activation of this emergency manual bypass override, during filling operations when no electrical power is available, shall cause a visible and audible indication of override status at the Level Alarm Control Panel when electrical power is restored to the system. Solenoids shall operate on 120 volts, 60 cycle, single phase power and be housed in an UL labeled explosion-proof case for Class I, Division 1, Group D areas with maximum temperature rating of "T2D" - 419 degrees F.

2.7.12.5 Control Valve Operation

The high liquid level control valve shall fully close when either the tank's fuel level is above the float operator's actuation point or the HHLA electronic level alarm sensor is activated. Valve shall fully open when the tank's fuel level is the below the float operator's actuation point and the HHLA electronic level alarm sensor is not activated. Means shall be provided to test the control system's response at the activation point.

2.7.13 Pipe Supports

2.7.13.1 Exterior to Tanks

The assembly shall include a Type 35 pipe slide and slide plate support mounted to Type 52 variable spring base support. The Type 52 support shall be mounted to a concrete support. Both supports shall be in accordance with MSS SP-58 and MSS SP-69. The pipe slide of the Type 35 support shall be carbon steel. The slide plate of the Type 35 support shall be PTFE in accordance with MS MIL-P-24396 or graphite coated carbon steel. The slide plate of the Type 35 support shall include side retainer walls and hold-down lugs.

2.7.13.2 Interior to Tanks

The assembly shall be constructed of steel angle frames with slotted bolt holes. The frames shall be in accordance with ASTM A 36. The assembly shall be held together with ASTM A 193 stainless steel nuts and bolts. Each leg of the assembly shall be welded to a 6-inch circular sheet of steel, which in turn shall be welded to the tank bottom. The entire assembly shall be coated with the same material as specified for the interior of the tank.

2.7.14 Flexible Ball Joints

Flexible ball joints shall be provided in the piping at the connections to the tank that will allow for the greater of 9-inches of tank settlement or the maximum allowable settlement of the tank. Stainless steel ball joints shall conform to ASTM A 351 and have polished stainless steel balls. Carbon steel ball joints shall conform to ASTM A 216 and have chromium plated carbon steel balls. Ball joints shall have pressure-molded mineral filled composition type internal seals, be suitable for continuous operation at 275 psig at 100 degrees F, be capable of 360 degree rotation, and be capable of accepting a 7 1/2 degree angular difference between the centerline of the pipe incoming to the joint on opposite sides.

2.7.15 Flanges

Flanges installed on equipment, fittings, or pipe shall be Class 150 pound flanges which are rated in accordance with ASME B16.5. Flange bolts and nuts shall be hexagonal and conform to ASTM A 307, Grade B. Pipe flange faces shall mate with equipment flange faces. Flanges shall be of the same material as the equipment, fitting, or pipe.

2.7.16 Pipe Flange Gaskets

Gaskets shall be 1/8-inch thick, full face or self-centering flat ring type NBR and be in accordance with ASME B16.21.

2.7.17 Electrically Isolating Gaskets for Flanges

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NOTE: Indicate the locations of each electrically isolating connection.

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Flanges shall be provided with an electrical insulating material of 1000 ohms minimum resistance conforming to ASTM D 229. The material shall be resistant to the effects of the type of fuel to be handled. Gaskets shall be full face. Flanges shall have a 0.03-inch thick, mylar insulating sleeve between the bolts and the holes. Bolts may have reduced shanks of diameter not less than the diameter at the root of the threads. Flanges shall be provided with 1/8-inch thick high-strength phenolic insulating washers.

2.7.18 Strainer

Strainer shall be in accordance with MS MIL-S-13789, except as modified herein. Strainer shall be the cleanable, basket or "Y" type, and be the same size as the pipeline. Strainer body shall be fabricated of [cast steel or brass] [Type 304 or 316 stainless steel] with the bottom drilled and tapped with a ball valve. The body shall have arrows clearly cast on

the sides indicating the direction of flow. Strainer shall be equipped with a removable cover and sediment screen. Screen shall be 60 mesh wire screen with larger wire mesh reinforcement. Screen shall be [22 gauge brass or corrosion-resistant steel] [Type 316 stainless steel]. The ratio of net effective strainer area to the area of the connecting pipe shall be not less than 3 to 1.

2.8 SUPPLEMENTAL COMPONENTS/SERVICES

2.8.1 Earthwork

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NOTE: See Additional Note H.
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Excavation and backfill shall be as specified in Section [_____], except as modified herein.

2.8.2 Cathodic Protection

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NOTE: See Additional Note I.
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Buried metallic components including pipe, anchors, conduit, etc. shall be provided with a cathodic protection system in accordance with Section [_____]. Cathodic protection for metal components that attach to a tank shall be coordinated and compatible with the tank corrosion control system. Cathodic protection of a storage tank's bottom shall be in accordance with Section 16642 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT).

2.8.3 Exterior Coatings for Miscellaneous Items

Painting required for exterior surfaces not otherwise specified, including items only primed at the factory, shall be painted as specified in Section [_____]. Steel surfaces to be externally coated or painted shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6 prior to the application of the coating.

2.8.4 Identification Markings

Tanks, pipe, equipment, etc. supplied under this section shall have identification markings applied in accordance with Section [_____].

2.8.5 Concrete

Concrete, including the ring wall, shall be supplied and installed in accordance with Section [_____].

PART 3 EXECUTION

3.1 INSTALLATION

The installation Contractor shall supervise the complete installation of the fueling system and perform all inspections and tests.

3.1.1 Sand Cushion

Cushion shall be spread, leveled, thoroughly compacted, and graded to provide a 5 percent sloped bottom to the center sump. Cushion shall be compacted to 100 percent of maximum density per MIL-STD 621, Test Method 100, Compaction Effort Designation CE55. Cushion shall be dampened with water to aid in compaction. Any damage to the finished sand cushion shall be repaired prior to the erection of the tank.

3.1.2 Storage Tank

Openings larger than 2-inches through the shell of the tank shall be reinforced. Shop and field fabrication shall meet the requirement of API Std 650 as adjusted herein. Spacing distances between weld seams and all shell penetrations (including manways) shall be in accordance with API Std 650. Work shall be fabricated and erected in accordance with the fabricator's approved erection drawings. Vertical appurtenances shall be plumb within a tolerance of 3-inches at one end over its length.

3.1.2.1 Outer Shell

The outer shell plates shall be approximately of equal length and preformed to the curvature of the tank, a compensating allowance in preforming being made at the welding edges of 1/4-inch thick plates to produce a finished shell without distortion from a true cylindrical surface at the welded joint. The maximum distortion tolerances shall not exceed the requirements in API Std 650. Plates shall be aligned, shaped and clamped in place prior to welding by press, roll or drawbar methods. Plates shaped by hammering shall not be accepted. Shell joints shall be butted and welded on each side to have complete penetration and fusion. Interior welds on the inside of the shell plates shall be smoothed by grinding or other suitable mechanical process to the extent that no sharp or abrupt irregularities remain and the welds present a smooth crown surface. Special care shall be taken to prevent excessive build up in all welded horizontal and vertical seams which may come in contact with the floating pan seals; rough spots, overbuild, reinforcing welds, spatter and or projections that may cause undue wear on the floating pan seals shall be removed.

3.1.2.2 Bottom

Bottom plate joints shall be lap welded with butt-welded annular bottom plates in accordance with API Std 650. Bottom plates shall be installed with the lower plates under the upper plates to permit drainage to center sump. Interior welds on the tank bottom plates shall be smoothed by grinding or other suitable mechanical process to the extent that no sharp or abrupt irregularities remain. Welds shall present a smooth crown surface for painting.

3.1.2.3 Grounding

Tank grounding shall be accomplished by installation of 10'-0" long, 3/4" diameter zinc coated steel ground rods interconnected by 4/0 AWG copper conductor with UL 83 type TW insulation. The maximum resistance to ground of the tank grounding system shall not exceed 25 ohms under normally dry conditions.

3.1.2.4 Defect Removal

The determination of limits of defective welding and repair of defective

welds shall be in accordance with API Std 650. Grind off rough surfaces on weld seams, sharp edges and corners to a radius of not less than 1/8-inch.

3.1.2.5 Welding Procedures

Welding shall be done using qualified welding procedures. The surface shall be cleaned before welding. Repair welds shall be made using an electrode or filler wire preferably smaller than that used in making the original weld. Repair welds shall meet the original weld's requirements.

3.1.2.6 Floor and Roof Welded Appurtenance Connections

Appurtenance connections to be welded to the floor or roof of a storage tank shall be made prior to application of the interior coating.

3.1.3 Floating Pan

After the tank fuel piping connections are completed, the interior and exterior coating has been inspected, approved, and the interior coating system has had at least 14 days to cure after the final coating was applied, the floating pan shall be installed. The floating pan shall be installed to have unrestricted vertical movement from its normal bottom to top position without damaging the tank, interior tank coating, or the floating pan.

3.1.4 Piping

Piping shall be free of traps and drain toward the storage tank(s). No pipe of any type shall be embedded in concrete pavement. Any pipe, fittings, or appurtenances found defective after installation shall be replaced. Pipe and accessories shall be handled carefully to assure a sound, undamaged condition. The interior of the pipe shall be thoroughly cleaned of all foreign matter and be kept clean during installation. The pipe shall not be laid in water or stored outside unprotected when weather conditions are unsuitable. When work is not in progress, open ends of pipe and fittings shall be securely closed so that water, earth, or other substances cannot enter the pipe or fittings. Cutting pipe, when necessary, shall be done without damage to the pipe. Pipe shall be reamed to true internal diameter after cutting to remove burrs. Pipe sections shall be installed as indicated and be complete prior to performing any piping tests.

3.1.5 Framed Instructions

Framed instructions shall include equipment layout, wiring and control diagrams, piping, valves, control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The framed instructions shall be framed under glass or laminated plastic and be posted where directed by the Contracting Officer. The framed instructions shall be posted before acceptance testing of the system.

3.2 TESTS

3.2.1 Sand Cushion Tests

A test of the sand shall be performed, prior to installing any storage tank bottom, to verify the amount of chlorides (ppm) and sulfates (ppm) within

the sand. The test shall also determine the pH value of the sand.

3.2.2 Storage Tank Tests

3.2.2.1 Vacuum Box

Following the successful completion of the radiographic inspection of tank welds, field welds performed on the bottom of any storage tank shall be subjected to a vacuum box test. A glass topped vacuum box which has a Hypalon and neoprene sealing gasket shall be used. The following procedures shall be followed:

(1) Apply a commercial bubble forming solution to the weld or area to be tested.

(2) Position the vacuum box over the area and slowly apply vacuum until a differential pressure of about 1 psi is achieved and held for at least 5 seconds while observing the solution for bubble formation.

(3) Continue to apply vacuum until a maximum differential pressure of 5 psi (11.5 feet of water or 10.2-inches of mercury) plus or minus 0.25 psi is achieved and held for at least 20 seconds while observing the solution for bubble formation.

3.2.2.2 Dye Penetrant

Following the successfully completion of the vacuum box test, the tank shell-to-bottom inside corner welds shall be subjected to a dye penetrant test. Apply a water soluble penetrating dye to the outside corner crevice before the outside weld is made. After four hours, inspect the inside fillet weld for evidence of dye penetration and correct defects, including removing dye from defective welds before corrective welding. Then remove dye from outside corner crevice and complete the remainder of the shell-to-bottom weld joint at the tank exterior.

3.2.2.3 Water Fill Tightness

Following the successful completion of the radiographic inspection of tank and internal piping welds, the tank shall be subjected to a hydrostatic water fill tightness test. The test shall include the following in sequential order:

(1) Prior to connecting water fill lines to the tank, not less than 6 equally spaced points shall be selected and marked on the ring wall. Grade elevations shall be taken at the top of the ring wall at each marked point.

(2) Water shall be flushed from the tank through each tank/pipe connection into the diked area to ensure any accumulated dirt and sediment is not flushed into the tank.

(3) The tank shall be filled in four increments equal to twenty-five percent of total capacity. At the end of each fill increment, two hours shall pass before grade elevations are taken at the top of the ring wall at each marked point. The tank shall also be visually inspected for leakage. Settlement values shall be calculated from the elevation differences. The appearance of damp spots shall be considered evidence of leakage, the

Contracting Officer shall be notified and the water remove immediately. Defects found during the test shall be corrected and the tank retested.

(4) The tank shall be maintained full of water until the settlement of the tank stabilizes or a period not less than less than 24 hours. After the water is removed, obtain grade elevations and determine settlement at each of the marked ring wall locations.

(5) The tank shall be emptied by draining the water into [the sanitary sewer] [_____].

(6) The tank bottom shall be inspected for standing water. No standing water shall be allowed anywhere on the sloped floor. If action has to be taken to correct standing water the water fill test shall again be conducted.

3.2.2.4 Tank Fuel Fill Tightness

Following the installation of the liquid level gauging equipment, the tank shall be subjected to a fuel fill tightness test. The tank shall be filled to one-half of total capacity and held at that level for an initial 12 hour period. The tank shall then be filled to total capacity and held at that level for a second 12 hour period. Following the temperature stabilization of the fuel, daily readings of the fuel levels shall be taken for a period of 10 days. Visual inspections and liquid level gauge readings shall be performed hourly to detect leaks during the initial and the second 12 hour periods of the test. Upon the acknowledgment of a leak, the Contracting Officer shall be notified immediately, the fuel shall be removed, the fuel vapor within the tank shall be removed, the tank interior and the tank site shall be cleaned, all defects corrected, and the fill test repeated. In the event fuel is removed from the tank, the internal coating system shall be visually inspected for damage before the tank is refilled.

3.2.2.5 Tracer Gas Test

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Note: If the "Tracer Gas Detection System" paragraphs in Part 2 were deleted, then delete the following paragraph.

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The tracer gas test shall be performed preceding the vacuum box test and be in accordance with the following:

(1) The test shall be conducted using an analytical method which can detect vapor movement through any void in the tank bottom.

(2) The testing company shall locate the leaks to within 3-inches of actual leak location by attempting to force or draw a detectable gas through the tank bottom.

(3) The gas used shall be non-explosive, non-toxic, and shall not be damaging to the ozone layer.

(4) The instrumentation shall be able to detect the leak as being

used at the accuracy described below.

(5) The test shall be conducted before application of any coating.

(6) A leak is characterized by the detection of 1 tenth (0.10) part per billion in air of the detectable gas on the opposite side from its point of injection.

(7) The tracer gas will be introduced to the underside of the tank using the monitoring well leak system piping. Gas release shall be pressure-regulated to prevent uplift and damage to the tank bottom.

3.2.3 Floating Pan Tests

Following the installation of a floating pan, the deck penetrations and rim area shall be subjected to a visual inspection for seal tightness. Leaks or seal deformations shall be corrected according to manufacturer's recommendations. Following the seal inspection, the floating pan shall be subjected to a flotation test. The tank shall be filled to 25 percent of the total capacity with fuel. While filling the tank, the top of the floating pan shall be visually inspected for fuel leakage. The appearance of damp spots on the top of the floating pan shall be considered evidence of leakage, the Contracting Officer shall be notified and the fuel remove immediately. Leaks shall be repaired and the flotation test performed again.

3.2.4 Piping Tests

3.2.4.1 Fuel Piping

Fuel piping shall be subjected to a pneumatic test. The water content of the air used for testing shall be no more than 20 percent relative humidity at 70 degrees F dry bulb. Dehumidifying equipment shall be provided on the suction or discharge side of the air compressor used to provide air for testing. Piping shall have pneumatic pressure applied at 15 psig and held for at least 4 continuous hours. Apply a commercial bubble forming solution to weld areas and carefully observe the solution film for bubble formation. During testing there shall be no bubbles or drop in pressure in the line except allowances shall be made for thermal expansion and contraction. In the event leaks are detected, the line shall be repaired and re-tested. Upon completion of satisfactory tests, the pressure shall be relieved, and the line immediately sealed. Suitable provision shall be made to prevent displacement of the piping during testing.

3.2.4.2 AFFF Piping

Piping shall have hydrostatic pressure applied at 200 psig and held for two continuous hours. During testing there shall be no drop in pressure in the line except allowances shall be made for thermal expansion and contraction. In the event leaks are detected, the line shall be repaired and re-tested. Upon completion of satisfactory tests, the pressure shall be relieved, and the line immediately sealed. Suitable provision shall be made to prevent displacement of the piping during testing.

3.3 INSPECTIONS

3.3.1 Storage Tank

3.3.1.1 Visual Inspection of Welds

Following the tank construction, each tank welded joint shall be visually inspected for defects. Welds with excess convexity and overlap shall be have excess metal removed. Welds with excess concavity, that are undersized, or show undercutting shall be cleaned and additional metal added. Welds with excess porosity, inclusions, lack of fusion, or incomplete penetration shall have the defective portions removed and re-welded. Cracks in a weld or a tank plate shall be removed by cutting around the entire crack and re-welding the defect. Welds with poor fit-up shall be cut apart and re-welded.

3.3.1.2 Radiographic Inspections

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NOTE: Ultrasonic inspections may be allowed in lieu of radiographic inspections. If used, ultransonic requirements will have to be added to the specification.

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Radiographic inspection procedures shall be in accordance with API Std 650. Defective welds shall be repaired and followed with a new radiographic inspection to the newly repaired area. The use of force (peening) or foreign materials to mask, fill in, seal, or disguise any welding defects shall not be permitted.

3.3.2 Piping

3.3.2.1 Visual Inspection of Welds

Following the piping inspection, each piping welded joint shall be visually inspected for defects. Welds with excess convexity and overlap shall be have excess metal removed. Welds with excess concavity, that are undersized, or show undercutting shall be cleaned and additional metal added. Welds with excess porosity, inclusions, lack of fusion, or incomplete penetration shall have the defective portions removed and re-welded. Cracks in a weld or a tank plate shall be removed by cutting around the entire crack and re-welding the defect. Welds with poor fit-up shall be cut apart and re-welded.

3.3.2.2 Radiographic Inspections

Piping welds performed in the field shall be 100 percent inspected radiographically. Interpretation of inspection results and limitations on the imperfections in the welds shall be in accordance with ASME B31.3, Chapter VI, Normal Fluid Service. The services of a qualified commercial or testing laboratory shall be employed for testing of piping welds. Costs of testing, including re-testing or repaired welds, shall be borne by the Contractor. Radiographic inspection procedures shall be in accordance with MIL-STD 271 or ASTM E 94. Weld ripples or surface irregularities that might mask or be confused with the radiographic image of any objectionable defect shall be removed by grinding or other suitable mechanical means. The weld surface shall be merged smoothly with the base metal surface. Defective welds shall be repaired and followed with a new radiographic inspection to the newly repaired area. The use of force (peening) or foreign materials to mask,fill in, seal, or disguise any welding defects shall not be permitted.

3.4 CLEANING AND ADJUSTING

3.4.1 Tank Interior

After completion of the tank coating but prior to the floating pan tests, interior surfaces within the tank shall be cleaned to eliminate any foreign matter such as water, dirt, debris, grease, oils, etc.

3.4.2 Tank Calibration

3.4.2.1 Tank Strapping

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Note: See Additional Note J.
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Tank strapping shall be performed on each storage tank and be performed in strict accordance with applicable recommendations and requirements of the API Std 2550. Circumferential measurements shall be determined by the [current operations] [critical measurements] method, as defined by API Std 2550.

3.4.2.2 Gauge Table

A gauge table shall be provided for each tank based on the tank strapping results. The gauge table shall read in feet and inches with the smallest increment of measure being 1/8-inch. Table shall indicate the capacity of the tank in gallons to the nearest gallon for each 1/8-inch increment when measured by a steel tape lowered through the roof at the manual gauge well. The master gauge table shall be typed on tracing cloth or other transparency suitable for reproduction. The gauge table shall be certified for accuracy by the firm which prepared the table and the installation Contractor.

3.4.3 Final Adjustments

Following system completion but prior to the demonstration, the entire system shall be adjusted to meet final design requirements. Each electronic level sensing alarm shall be tested for proper operation. Fuel level gauges shall be adjusted and calibrated in accordance with the manufacturer's instructions. Calibration of level gauges shall be supervised by a manufacturer's representative. The tank's water draw-off system shall be tested to verify proper operation. The draw-off system shall be filled with a water and fuel mixture. The separation of the water and fuel shall be verified through the system's sight glass.

3.5 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of [_____] hours of normal working time and start after the system is functionally completed but prior to final system acceptance. The field instructions shall cover all of the items contained in the operation and maintenance manuals as well as demonstrations of routine maintenance operations.

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ADDITIONAL NOTES

NOTE A: This specification is intended for use with field-fabricated, aboveground, vertical, steel storage tanks which range in size between 2,500 barrels and 100,000 barrels. Indicate the type of fuel to be stored in tank. See the Standard Drawings for guidance.

NOTE B: The amounts of fuel and water needed for testing and flushing could be substantial in quantity and expense. Verify if the quantities are readily available, who should supply them, who should verify their quality, who should be notified of these activities, etc.

NOTE C: In a salt water environment substitute acceptable non-corroding metal such as but not limited to nickel-copper, 304 stainless steel, or monel. Aluminum is unacceptable. Nomenclature (or system identification) should be established by the designer.

NOTE D: Storage tanks housing non-aviation fuel (i.e. diesel, gasoline, etc.) will only be coated on the floor and 1 meter up the tank shell.

Tanks storing aviation fuel will be classified as either primary or secondary type based upon their function. Primary storage tanks issue fuel directly to a flight line or refueler tanker without any operating/interim storage. Secondary storage tanks will provide operating/interim storage for primary storage tanks. Fuel from a secondary storage tank will not directly feed any flight line or refueler tanker. Primary storage tanks will be 100 percent internally coated. Secondary storage tanks will only be coated on the floor and 1 meter up the tank shell. Consider 100 percent internal tank coatings for all applications based on cleaning and maintenance costs. Delete the last three sentences if 100 percent of the internal surfaces of the tank is not coated.

NOTE E: Include the first set of brackets when tanks with a storage capacity of 25,000 barrels or less are to be included in the design. Include the second set of brackets when tanks with a storage capacity greater than 25,000 barrels are included in the design. Include equipment locations and fire department connection points. The designer will be responsible for laying out the entire system, performing all necessary hydraulic calculations, and sizing the piping. The system will be designed in

accordance with NFPA 11 and the schedule shown on the standard drawings.

NOTE F: Indicate the type of pipe material if it is not called out in the specification. Using lined carbon steel pipe in lieu of unlined carbon steel pipe is recommended for all applications except where this specification requires otherwise, however funding may limit the application. Lining small piping is difficult and should be recognized. Lined piping can only be used in conjunction with flange connections since welding will damage the interior lining. Discharge piping shall be provided so that released liquid can be captured in a bucket for proper disposal.

NOTE G: Relief valves will typically be placed down stream of control valves to relieve the pressure buildup created when the control valve is closed. Indicate the operating pressure required for each valve. Also, use relief valves to relieve possible thermal expansion in a pipe line if no other provisions exist.

NOTE H: Ensure that the grading specification includes the backfill and compaction that coordinates with the maximum allowable settlement. State the maximum allowable settlement on the drawings. The earthwork specification will separately address backfill and compaction requirements both under the FML and for other surrounding areas.

NOTE I: Indicate the location of each cathodic protection system. The last sentence will be included only if required by state and local EPA requirements or if deemed necessary by an experienced corrosion engineer.

NOTE J: Select the degree of accuracy needed. The current operations method should be used for tanks in interdepartmental service and is less precise. The critical measurements method should be used for tanks in interdepartmental service and includes the effects of hydrostatic bulge, temperature changes, tilt, and irregular tank bottoms.

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--End of Section--